RESOURCE ASSESSMENT AND DEVELOPMENT ANALYSIS FOR THE THE UPPER SUGAR RIVER AND BADGER MILL CREEK SOUTHWEST OF VERONA, WI

SUMMARY OF REPORT

MARCH 2008

PROJECT NO. 1297

FOR:

THE CITY OF VERONA, WISCONSIN

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PURPOSE OF STUDY

The purpose of this study was to develop recommendations for urban development standards and environmental corridor boundaries that will provide protection to the identified water resource features of the study area. These recommendations are intended to be "resource-based" and not "policy-based", to provide the basis for an improved approach to protection of water quality and water resources as part of regional water quality management planning. It is expected that the analyses and recommendations contained in this study will be part of the City of Verona's request to the Capital Area Regional Planning Commission and Wisconsin DNR for an extension of the Urban Service Area boundary to include the study area.

This project was conducted for the City of Verona, in response to a resolution adopted by the City in June 2005, "supporting natural resources planning in portions of the Badger Mill Creek and Sugar River watershed". This resolution identified the study area, and committed the City to complete a natural resources planning process to define areas suitable for development that will protect natural resource features and provide compliance with regulations.

STUDY AREA DESCRIPTION

The study area for this project includes 1702 acres located on the southwest margin of the current urban service area for the City of Verona. The area includes the intersection of Highways 69 and 151. Badger Mill Creek, the Upper Sugar River, the confluence of the Upper Sugar River and Badger Mill Creek, and the Sugar River Wetlands State Natural Area are key resources in the study area (Figure 1).

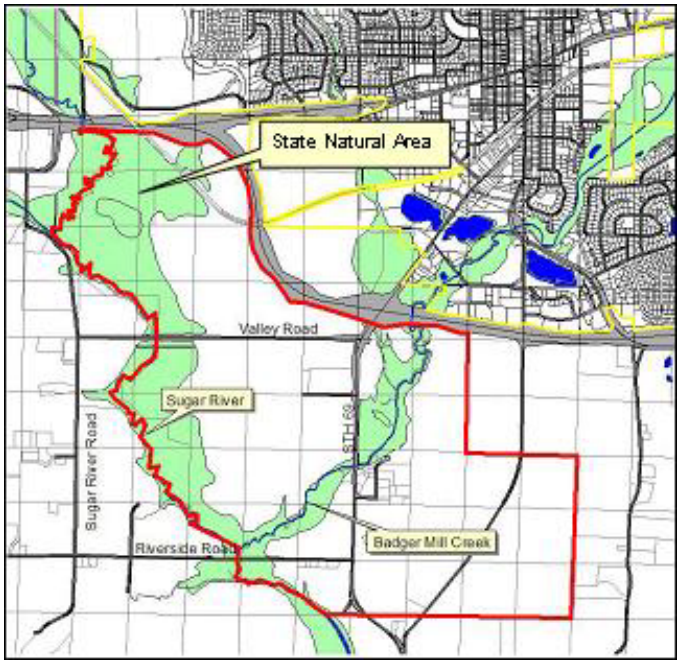

Figure 1. Study Area Map

Land use in the study area is primarily agricultural. Topography is variable, and includes areas of steep slopes in upland areas in the central and eastern portion of the area, contrasting with very flat terrain adjacent to badger Mill Creek and the sugar River.

The study area includes the downstream limit of the Badger Mill Creek watershed, and a small portion of the Sugar River watershed. Upstream of the study area, the Badger Mill Creek watershed includes extensive areas of existing urban development. In contrast, the Sugar River

watershed upstream of the study area is relatively undeveloped. Future land use conditions projected by the Capital Area Regional Planning Commission indicates that the Badger Mill Creek watershed will have a substantially higher percentage of impervious area than the Sugar River. Watershed area and projected impervious area percentages are summarized in Table 1.

Table 1. Watershed Development Summary

Characteristic	Upper Sugar River	Badger Mill Creek	Locust Road Dry Tributary
Total watershed area at downstream limit of study area	47.5 mi^2	32.1 mi^2	1.1 mi^2
Watershed area within study area	802 acres	585 acres	315 acres
Fraction of total watershed included in study area	2%	2%	73%
Current impervious cover	10%	20%	NA
Projected impervious cover in 2050, based on land-use projections developed by CARPC	14%	31%	NA

BACKGROUND TO KEY WATER RESOURCE ISSUES

The ability of Badger Mill Creek and the Sugar River to support trout populations has received attention in defining the value of these resources. Both Badger Mill Creek and the Upper Sugar River support brown trout populations, although neither is classified as a trout stream by the Wisconsin Department of Natural Resources. The Upper Sugar River is classified as a Cold Water Community and an Exceptional Resource Water (under Sec. 281.15). Badger Mill Creek is considered a Cold Water Community in the study area and as far upstream as Bruce Street; upstream of that point it is classified as a Limited Forage Fishery and Warm Water Forage Fishery. Neither stream is on the 303(d) list of impaired waters. The Dane County Water Body Classification study lists both streams as Class 2 streams with management objectives of protection and restoration (Table 2).

An additional significant natural resource feature within the study area is the Sugar River Wetlands State Natural Area, which occupies more than 100 acres in the northernmost part of the study area along the Upper Sugar River. It contains sedge meadows, calcareous fens, emergent aquatics, shrub-carr, and wet-mesic prairie. Numerous rare plant and animal species are also found in the area.

These resources are highly valued and have been the focus of much previous work by the City of Verona, Dane County, the Madison Metropolitan Sewerage District, the Wisconsin Department of

Natural Resources, the U.S. Geological Survey, and the Upper Sugar River Watershed Association. The Dane County Water Quality Plan calls for vigorous enforcement and possible extension of County stormwater and erosion control standards to protect the Sugar River and its tributaries. It also encourages participation between units of government and conservation groups.

Table 2. Watershed Plans and Objectives for the Upper Sugar River and Badger Mill Creek

Plan	Classification & Objectives
Dane Co. Water Body Classification & Objectives	▪ Developing / Impacted ▪ Protection/restoration – reduce runoff & imperviousness
Dane Co. Water Quality Plan (2004) priorities	▪ Enforce & possibly expand minimum Co. ordinance requirements to protect USR & tributaries ▪ Manage USR & BMC in cooperation w/ other units of government & conservation groups ▪ Evaluate road deicer use & adopt salt use management policy
Town of Verona Land Use Plan	▪ Protect and improve the quality of surface water and groundwater ▪ Promote protection of natural areas ▪ Support Dane County Parks and Open Space Plan ▪ Promote environmental restoration and habitat preservation ▪ Protect highly productive soils for agricultural use
Dane County Parks and Open Space Plan	▪ Natural Resource Areas in floodplains. ▪ High priorities for conservation.

STUDY APPROACH

This project was comprised of two phases, with the bulk of the work conducted in 2007.

- Phase 1 included a review of available data and reports, followed by an identification of data gaps that would need to be addressed to understand the critical water resources of the study

area, and the hydrologic conditions necessary to maintain these resources. This first phase of the project included several meetings with a project study stakeholder group, and a public meeting to provide an interim description of data collection and resource identification. This public meeting was conducted at the Verona City Hall.

- Phase 2 of the project consisted definition of the sensitivity of identified water resource features to changes in groundwater and surface water quantity and quality. This sensitivity analysis was followed by an analysis of alternative upland development standards and environmental corridor characteristics that would minimize the potential for resource degradation. The recommended development area hydrologic performance standards and environmental corridor criteria were reviewed with the City in an iterative process.

The full study report documents the major data collection activities, analyses of resource sensitivity and development impacts, and presents recommendations for development standards and environmental corridor definition.

STUDY PARTICIPANTS

This study was conducted by Montgomery Associates: Resource Solutions, LLC as prime consultant to the City of Verona. Subconsultants to Montgomery Associates for conduct of this work included Natural Resource Consulting, Inc., and Archaeological Consulting and Services, Inc.

Organizations, municipalities, and agency representatives that participated in the stakeholder discussions and public meetings included the following:

- City of Verona
- Town of Verona
- City of Madison
- Wisconsin DNR, South Central Region
- Madison Metropolitan Sewerage District
- Capital Area Regional Planning Commission
- Upper Sugar River Watershed Association
- Natural Heritage Land Trust

Additionally, a number of interested citizens, primarily residents living within or near to the study area, participated in the public meetings and provided questions and comments.

SUMMARY OF FINDINGS

Tables 3 and 4 summarize the condition of the aquatic resources in the study area and their sensitivity to development-related impacts.

Table 3. Summary of Study Area Resource Assessment

Issue	Upper Sugar River	Badger Mill Cr	Locust Road Dry Tributary
Stream baseflow	Modest inflow in study area. Apparent recharge rate 5.5 – 7.5 in/yr.	30 - 50% effluent. Low inflow in study area. Apparent recharge rate 2 – 3 in/yr.	NA
Flashiness of runoff response	Low (R-B Index 0.15) Wetlands help attenuate peaks.	High (R-B Index 0.6)	NA
Temperature	Fair for stocking, marginal for natural reproduction.	Marginal for adult trout	NA
Water quality	DO poor for juvenile trout. Well below EPA standards for chlorides & metals	DO marginal for adult trout & poor for juveniles. Near EPA chronic standards for chloride, cadmium & lead.	NA
Channel – habitat & stability	Fair above confluence. Impacted below confluence	Substantial erosion & sedimentation	NA
Wetland quality	Low - Medium	Low	None documented
Upland resources	Primarily agricultural land. Minimal forest.	Primarily agricultural land. Minimal forest.	Small woodlands present
Fish	Poor-fair rankings since 1999. – High tolerant & omnivore spp. – Lack of darters & insectivores Indicates degraded and undesirable conditions.	Very Poor-fair rankings – High tolerant & omnivore spp. – No suckers; low darter, intolerant & insectivore spp. Indicates higher level of degraded and undesirable conditions.	NA

Issue	Upper Sugar River	Badger Mill Cr	Locust Road Dry Tributary
Invertebrates	– EPT approx. 20% in the spring and between 36-54% in the fall – BI values fair-very good – Indicates low to modest water quality impairment	– EPT approx 11% in the spring and 22-31% in the fall – BI values fair-very good – Indicates low to modest water quality impairment	NA
Soil infiltration potential	Valley bottom – High Uplands - Low	Valley bottom – High Uplands - Low	Low
Future upstream development impacts	Modest runoff volume increase		NA

Table 4. Resource Sensitivity Summary

Issue	Upper Sugar River	Badger Mill Cr	State Natural Area Wetlands
Recharge	High	High	Moderate
Runoff / stream stability	Low - Moderate	High	NA
Municipal water supply withdrawal	Low	Low	Low
Water quality	Low (Most stormwater constituents substantially reduced by County sediment control requirements. Chloride primary concern.)	Moderate (Most stormwater constituents substantially reduced by County sediment control requirements. Chloride primary concern.)	High (Native plant species sensitive to stormwater quality impacts.)
Impacts from upstream development	Moderate (Modest increase in runoff volume & peaks expected.)		

DEVELOPMENT RECOMMENDATIONS

Potentially developable land in the study area can be divided into 8 sub-areas based on soil conditions (upland vs. lowland) and receiving stream (Upper Sugar River vs. Badger Mill Creek). Recommendations for development of these 8 areas are summarized in Table 5 and Plate 2. Note that individual development projects will need to verify site-specific conditions and develop design details that achieve the performance standards.

Even with the more protective performance standards we recommend, some modest impacts are possible, including increased runoff volume and increased concentrations of typical urban stormwater constituents. The development recommendations include mitigation measures to address these potential impacts. (1) The riparian buffers will be wider than for existing conditions in most locations, and this will enhance streambank stability. (2) The aggressive recharge goals should meet or exceed existing groundwater recharge, maintaining or possibly improving baseflow and stream temperature. Maintaining adequate water temperature will provide some protection against toxicity impacts on the fishery due to stormwater pollutants, which typically are modest where water temperatures are adequate.

Table 5. Recommendations Summary

Issue	Upper Sugar River	Badger Mill Cr	Locust Road Dry Tributary
Performance standards	County ordinance, Ch. 14 plus: Maintain 7.6 in/yr recharge	County ordinance, Ch. 14 plus: Maintain 90% predevelopment infiltration volume with 2% cap (both residential & non-residential sites)	County ordinance, Ch. 14
Exemptions & exclusions	• Apply requirements to all sites, including <20,000 ft2. • Remove infiltration exemption for new roads. • Apply high standard to demonstration of soils unsuitable for infiltration in valley bottom. • If site is unsuitable for infiltration due to soil, bedrock or groundwater conditions, runoff volume reduction shall be achieved through evapotranspiration (e.g. biofiltration) to the maximum extent practicable (up to the 2% cap).		
Environmental corridor extent	• Public land intended for resource protection • Regulatory wetlands • Floodway (flood fringe shown on Plate 2 but not part of environmental corridor) • Minimum 75 ft buffer beyond OHWM of perennial streams & wetland boundaries • Minimum 25 ft buffer for intermittent streams (75 ft total width minimum)		

Issue	Upper Sugar River Badger Mill Cr	Locust Road Dry Tributary
Environmental corridor design	Environmental corridor to be designed with water protection and environmental restoration features, including: • No direct discharge of storm sewers to streams or watercourses; • Grading to provide distribution and infiltration of runoff water entering the corridor with multiple points of discharge to the stream; • Planting of native vegetation; • Planting of trees, with a minimum objective of shading the water surface and enhancing riparian habitat; • Stabilizing bare soil or unstable banks above the OHWM; • Require design of open corridor drainage ways at locations shown approximately on the map, including designs for erosion control and stability, water quality filtration and infiltration opportunities; • Provide trail access within corridor for management access, outdoor education, and recreation.	Require design of open corridor drainage ways at approximate locations shown on Plate 2, including designs for erosion control and stability, water quality filtration and infiltration opportunities.

Issue	Upper Sugar River	Badger Mill Cr	Locust Road Dry Tributary
Management of design and implementation	Design of stormwater management features to be reviewed and approved by City and CARPC at time of GDP or preliminary plat submittal. Identification of ownership and long-term operation and maintenance procedures to be determined and approved at that time. Details of design construction plans and specifications, including any stormwater conveyance and treatment features in the environmental corridor, to be reviewed and approved by the City prior to construction; CARPC to be a resource in final design review. Final designs submittal will include a schedule of construction and identification of responsibilities for quality control and as-built documentation of drainage-related features between private and public parties. Detailed review of drainage and environmental corridor feature construction to be monitored in the field by designated quality control personnel, with documentation to and quality assurance by the City or designated agent. City to approve all drainage and environmental corridor construction upon completion. City to approve an agricultural land use water quality plan to be approved by City as part of annexation, or inclusion in the Urban Service Area if consolidation occurs.		
Monitoring and adaptive management	A regional water quality monitoring effort should be undertaken to assess the effectiveness of management policies. Suggested parameters include discharge, water quality parameters (to be determined) and periodic fish surveys (responsible party to be determined). Stream monitoring should be evaluated approximately every five years, and the management plan adjusted accordingly.		Periodic monitoring of soil erosion and stormwater sampling for TSS (responsible party to be determined)

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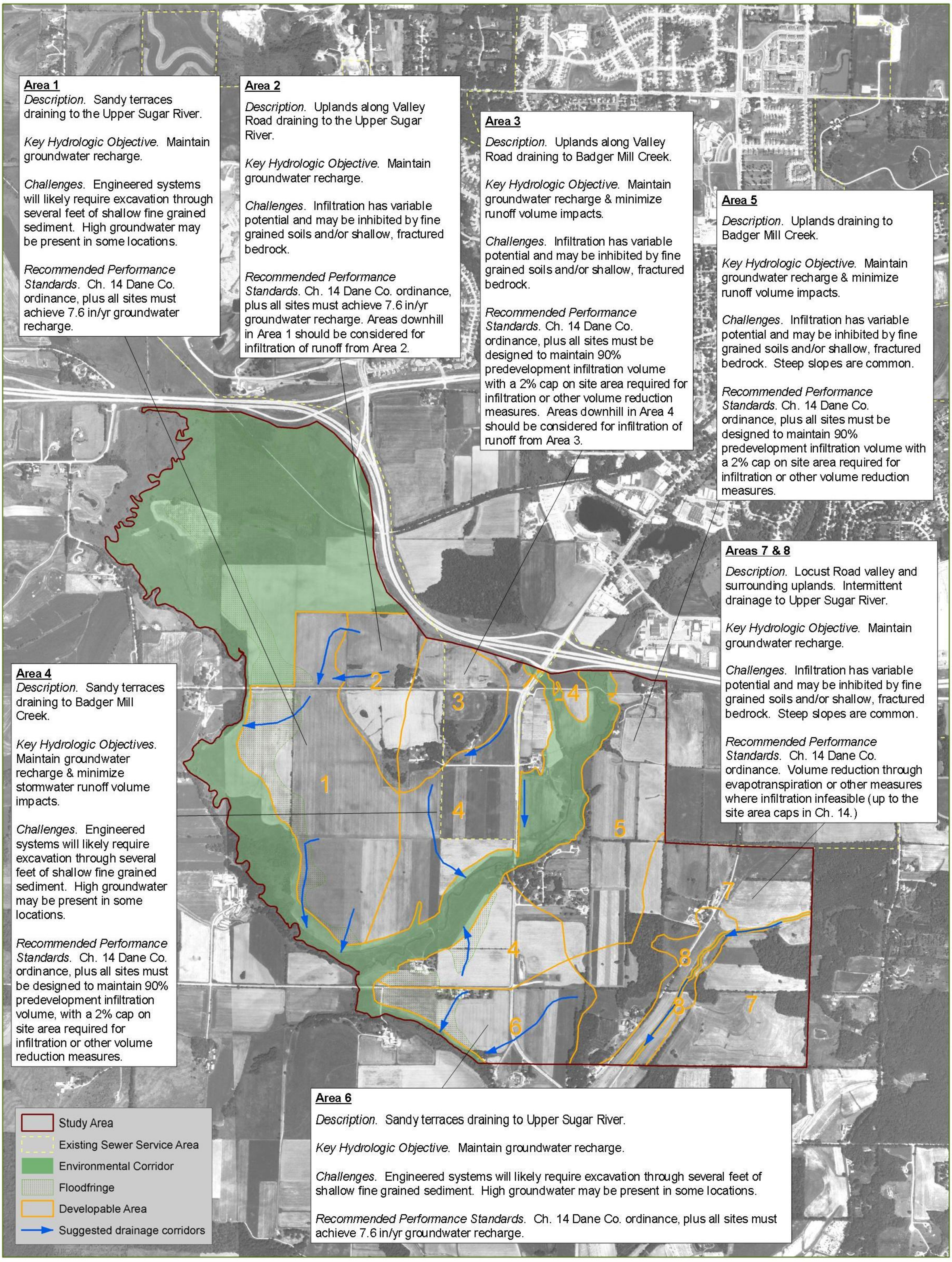

Area 1

Description. Sandy terraces draining to the Upper Sugar River.

Key Hydrologic Objective. Maintain groundwater recharge.

Challenges. Engineered systems will likely require excavation through several feet of shallow fine grained sediment. High groundwater may be present in some locations.

Recommended Performance Standards. Ch. 14 Dane Co. ordinance, plus all sites must achieve 7.6 in/yr groundwater recharge.

Area 2

Description. Uplands along Valley Road draining to the Upper Sugar River.

Key Hydrologic Objective. Maintain groundwater recharge.

Challenges. Infiltration has variable potential and may be inhibited by fine grained soils and/or shallow, fractured bedrock.

Recommended Performance Standards. Ch. 14 Dane Co. ordinance, plus all sites must achieve 7.6 in/yr groundwater recharge. Areas downhill in Area 1 should be considered for infiltration of runoff from Area 2.

Area 3

Description. Uplands along Valley Road draining to Badger Mill Creek.

Key Hydrologic Objective. Maintain groundwater recharge & minimize runoff volume impacts.

Challenges. Infiltration has variable potential and may be inhibited by fine grained soils and/or shallow, fractured bedrock.

Recommended Performance Standards. Ch. 14 Dane Co. ordinance, plus all sites must be designed to maintain 90% predevelopment infiltration volume with a 2% cap on site area required for infiltration or other volume reduction measures. Areas downhill in Area 4 should be considered for infiltration of runoff from Area 3.

Area 5

Description. Uplands draining to Badger Mill Creek.

Key Hydrologic Objective. Maintain groundwater recharge & minimize runoff volume impacts.

Challenges. Infiltration has variable potential and may be inhibited by fine grained soils and/or shallow, fractured bedrock. Steep slopes are common.

Recommended Performance Standards. Ch. 14 Dane Co. ordinance, plus all sites must be designed to maintain 90% predevelopment infiltration volume with a 2% cap on site area required for infiltration or other volume reduction measures.

Areas 7 & 8

Description. Locust Road valley and surrounding uplands. Intermittent drainage to Upper Sugar River.

Key Hydrologic Objective. Maintain groundwater recharge.

Challenges. Infiltration has variable potential and may be inhibited by fine grained soils and/or shallow, fractured bedrock. Steep slopes are common.

Recommended Performance Standards. Ch. 14 Dane Co. ordinance. Volume reduction through evapotranspiration or other measures where infiltration infeasible (up to the site area caps in Ch. 14.)

Area 4

Description. Sandy terraces draining to Badger Mill Creek.

Key Hydrologic Objectives. Maintain groundwater recharge & minimize stormwater runoff volume impacts.

Challenges. Engineered systems will likely require excavation through several feet of shallow fine grained sediment. High groundwater may be present in some locations.

Recommended Performance Standards. Ch. 14 Dane Co. ordinance, plus all sites must be designed to maintain 90% predevelopment infiltration volume, with a 2% cap on site area required for infiltration or other volume reduction measures.

Area 6

Description. Sandy terraces draining to Upper Sugar River.

Key Hydrologic Objective. Maintain groundwater recharge.

Challenges. Engineered systems will likely require excavation through several feet of shallow fine grained sediment. High groundwater may be present in some locations.

Recommended Performance Standards. Ch. 14 Dane Co. ordinance, plus all sites must achieve 7.6 in/yr groundwater recharge.

- Study Area
- Existing Sewer Service Area
- Environmental Corridor
- Floodfringe
- Developable Area
- Suggested drainage corridors

Miles

0 0.25 0.5 1

Boundaries approximate. Use for planning purposes only.

Produced by SJG
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Plate 2
Development Recommendations